possible by the deformation of the lens fashioned in this manner.

The invention is further explained by embodiments with the aid of the appended drawings, wherein:

FIG. 1 shows a first embodiment of a bivisual artificial intraocular lens in which a near range zone and a far range zone are disposed concentrically with one another,

FIG. 2 shows an embodiment of an artificial, intraocular ophthalmic lens in which near range zones and far range zones are formed by concentric annular surfaces,

FIG. 3 shows an embodiment in which the optical lens portion is divided into two halves by a vertical line separating it into a near range zone and a far range zone,

FIG. 4 shows an embodiment having sector-shaped near and far range zones,

FIG. 5 shows an embodiment of the intraocular lens which is formed by an envelope filled with a transparent fluid, in the state for near vision,

FIG. 6 shows the embodiment represented in FIG. 5, in the state for far vision,

FIG. 7 is a top view of the embodiment represented in FIGS. 5 and 6.

In the embodiment of a bivisual intraocular lens of FIG. 1, an optical lens portion 1 has a far range zone F disposed in the center in the form of a circular area, and concentrically around it, a near range zone N in the form of an annular area. However, the far range portion F can also be disposed in the center and the near portion N around it. The lens body has bores 3 as near as possible to the circumferential margin of the lens, in a peripheral annular lens portion 2 surrounding the optical lens portion 1, so to avoid interference with the optical function of the lens. Holding loops 4 serve to fix the lens in the eye. The normal size and position of the pupil is indicated by the dashed line 7.

The embodiment shown in FIG. 2, of a multifocal, intraocular artificial ophthalmic lens has in the center of the optical lens portion 1 a far range zone F in the form of a circular area, and an annular near range zone N disposed concentrically around it; these are followed radially towards the periphery by additional annular, concentrically-disposed, far and near range zones F and N. It is also possible, however, to dispose the near range zone N in the center of the optical lens portion 1 and a concentric annular far range zone F around it, and so on. In the peripheral annular lens portion 2, which is not optically active, the bores 3 are provided, whereby, as in the embodiment in FIG. 1, the lens can be turned to a suitable position, if necessary, after the implantation of the lens and before the final closing of the eye. These bores 3 are so arranged that they do not interfere with the optical functioning of the lens. The lens furthermore has the holding loops 4 whereby the lens can be fixed.

The embodiment in FIG. 3 is of the bivisual type like the embodiment in FIG. 1, but the line of separation between the near range zone N and the far range zone F runs, when the lens body is installed, from the upper margin of the lens to the bottom margin of the lens, and separates the optical lens portion 1 into two halves of which the one half forms the far range zone F and the other half the near range zone N. With the lens inserted into the eye, the near range zone N is situated closer to the wearer's nose than the far range zone F. In this example, again, the bores 3 are disposed in a lens area close to the lens margin, so that the optical function of the lens will not be impaired. Holding loops 4 serve to fix the lens in the eye.

In the embodiment represented in FIG. 4, two far range zones F and two near range zones N of sector shape are provided, and have equal sector angles. In the embodiment represented, the sector angles are 90°. It is, however, also possible to provide a greater number of near and far range zones with correspondingly smaller sector angles. The near and far range zones N and F are disposed alternately around the lens axis. Bores 3 are situated in a peripheral lens portion 2, which is optically inactive. Fixation means 4 again serve to fix the lens in the eye.

Other fixation means can be provided for the artificial opthalmic lens. Known fixation means are described in German patent publication Nos. 25 04 540, 26 05 847, 26 54 999 and 27 25 219.

As may be seen in the embodiments of FIGS. 1–4 the near and far range zones (N and F) of the transparent optical lens portion immediately in front of the pupil have approximately equal areas symmetrically from the axis of the optical lens.

In FIG. 5, there is shown in section an embodiment of an artificial intraocular lens which consists of a flexible, transparent envelope 5 filled with a transparent fluid. This envelope 5 with the fluid therein substantially forms the optical lens portion. In FIG. 5 is represented the state of the lens for near vision. The envelope filled with the transparent fluid is attached to the ciliary muscle of the eye by means of a fastening fringe 6 which is anchored in the envelope. In this manner the ciliary muscle acts as it does on the natural eye lens, i.e., when the ciliary muscle contracts, the illustrated near action of the lens respresented in FIG. 5 results, since the lens becomes more spherical and thus receives a greater refracting power. When the ciliary muscle elongates, a tension is exerted on the envelope 5 filled with the transparent fluid and flattens the latter so that it is given the shape represented in FIG. 6. The lens then has a reduced refracting power, and serves for far vision. In this manner a continuous change of focus from near vision to far vision can be made possible in conjunction with the action of the ciliary muscle.

In FIG. 7 is shown a top view of the embodiment represented in cross section in FIGS. 5 and 6, and the anchoring of the fastening fringe 6 in the flexible envelope body 5 can also be seen.

It will be understood that the specification and examples are illustrative but not limitative of the present invention and that other embodiments within the spirit and scope of the invention will suggest themselves to those skilled in the art.

What is claimed is:

1. In a multifocal, especially bifocal, artificial, intraocular, ophthalmic lens adapted to be implanted in the eye at a fixed position and having a transparent optical lens portion for covering the pupil of the iris and means for holding said lens portion in a fixed position in the eye, the improvement wherein near range and far range zones (N and F) of the optical lens portion have approximately equal areas symmetrically about the axis of the optical lens portion, such that rays received by the pupil of the eye in which the lens is fixed pass through both near and far range zones of the lens of approximately equal area, for simultaneous, sharp near and far vision.

2. Ophthalmic lens of claim 1, characterized in that the near range and far range zones (N and F) are concentric with one another.